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Rinzaki

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[54] **AIR INTAKE ARRANGEMENT FOR OUTBOARD MARINE ENGINES**

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[51] **Int. Cl.**[6] **B63H 21/24**

[52] **U.S. Cl.** **440/77**; 181/229; 440/88

[58] **Field of Search** ..... 440/77, 88, 900; 181/229; 123/195 P

[56] **References Cited**

U.S. PATENT DOCUMENTS

3,610,198	10/1971	Alexanddrowicz	440/77
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[57] **ABSTRACT**

In an outboard marine engine, an air intake passage is mostly defined by a partition wall which extends substantially horizontally inside the engine cover so as to define an air introduction chamber above an engine room accommodating an engine. The air intake passage is defined in such a manner that the intake air is initially guided along a horizontal path between upper and lower plates, and is forced upward through an opening in the upper plate by a first vertical baffle plate extending between front edges of the upper and lower plates before it goes over a second vertical baffle plate extending from the upper plate and finally enters the engine room. Therefore, any heavier contents such as water droplets are effectively removed from the intake air by the actions of inertia and the gravitational force. Because the intake air passage is mostly defined by the partition wall, any design change in the air intake arrangement can be readily and economically accommodated by changing the partition wall.

5 Claims, 3 Drawing Sheets

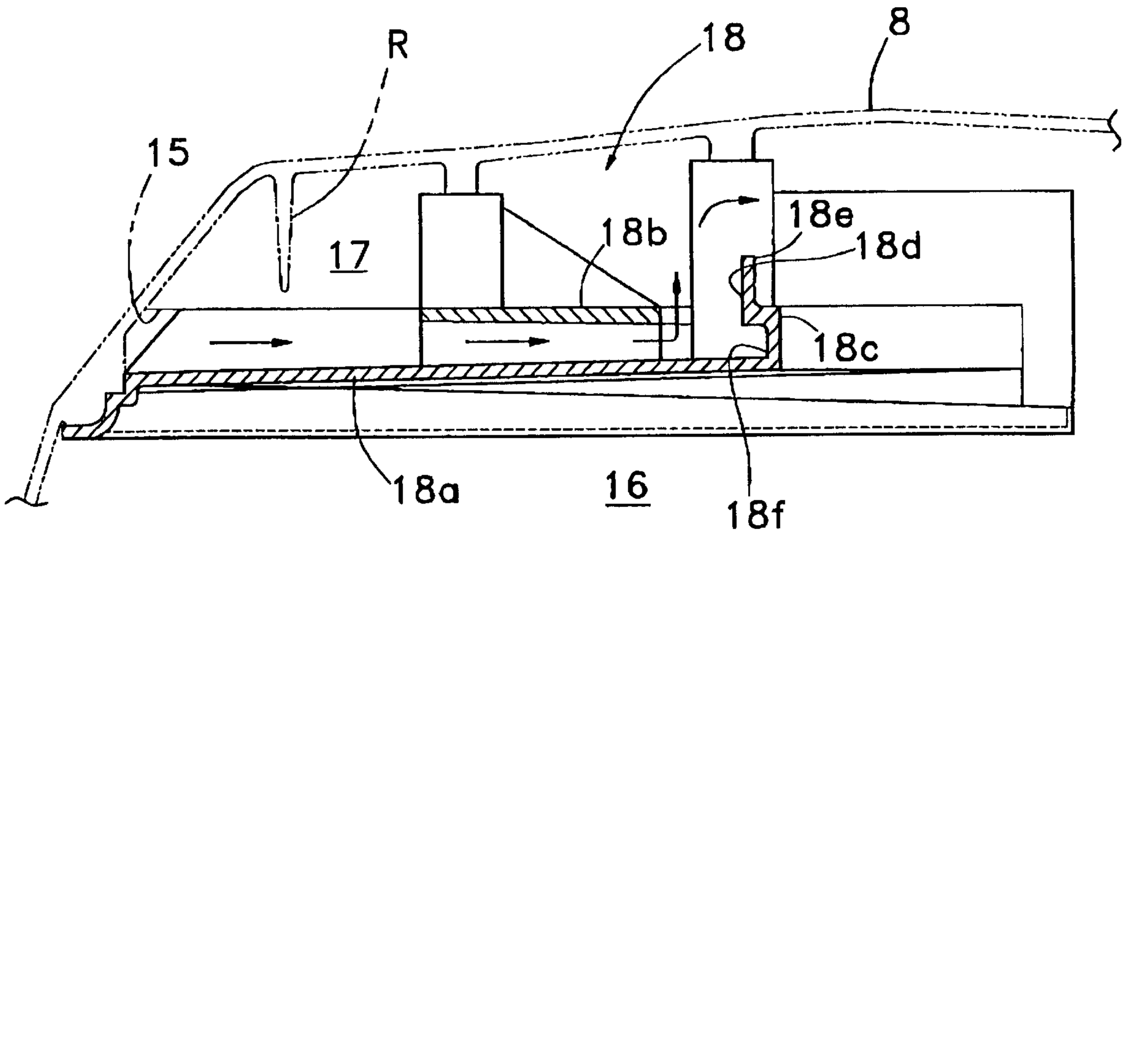
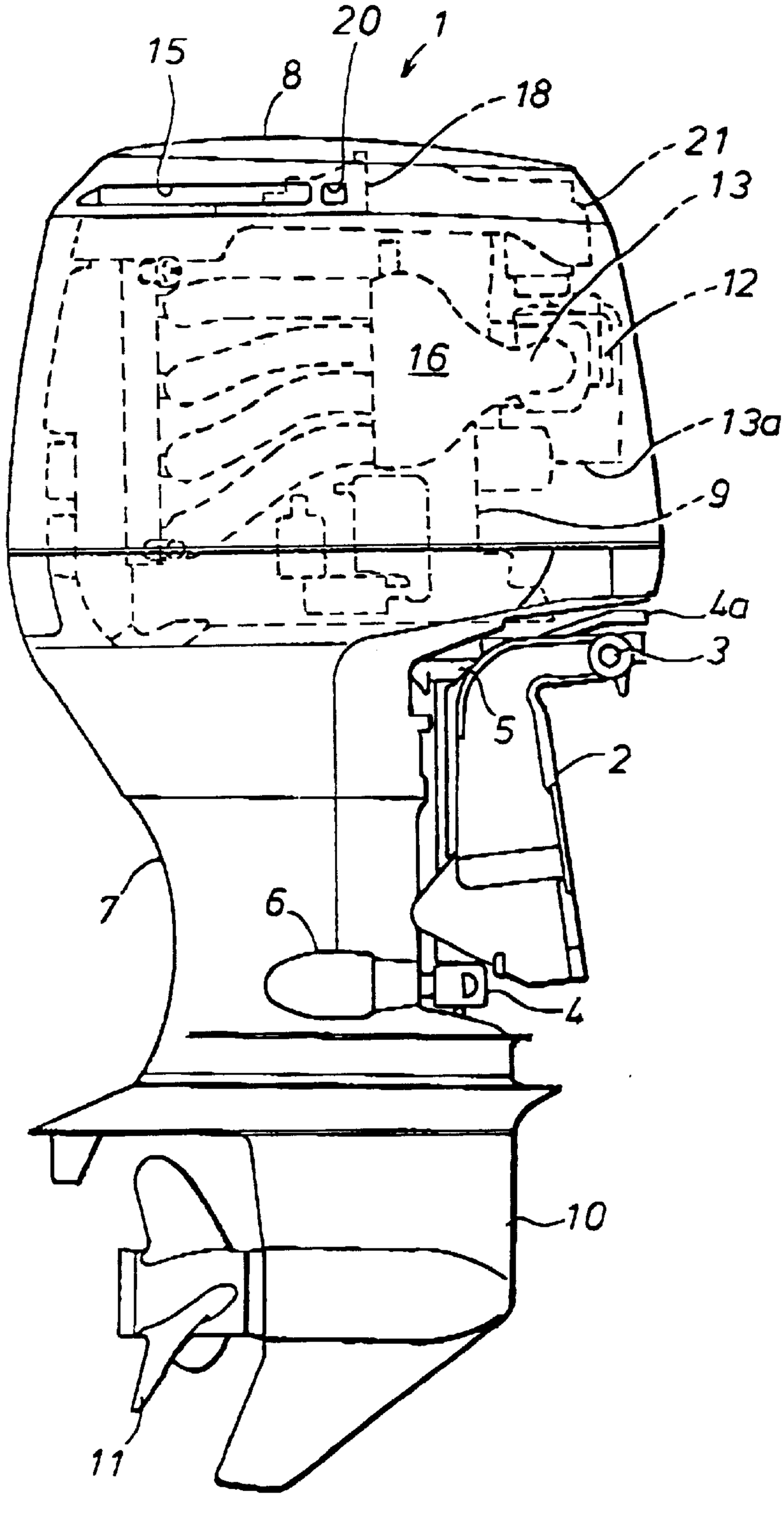


Fig. 1



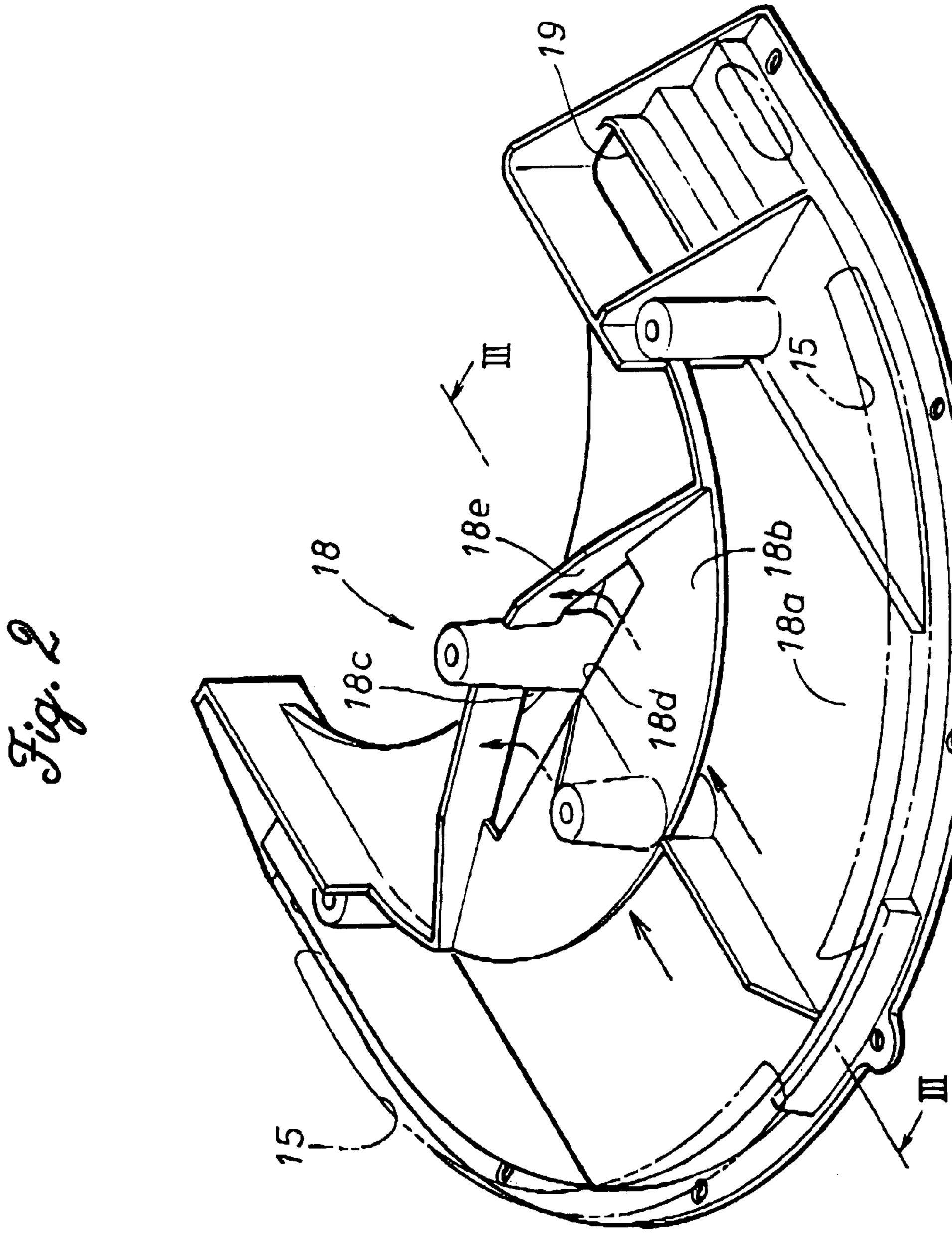


Fig. 2

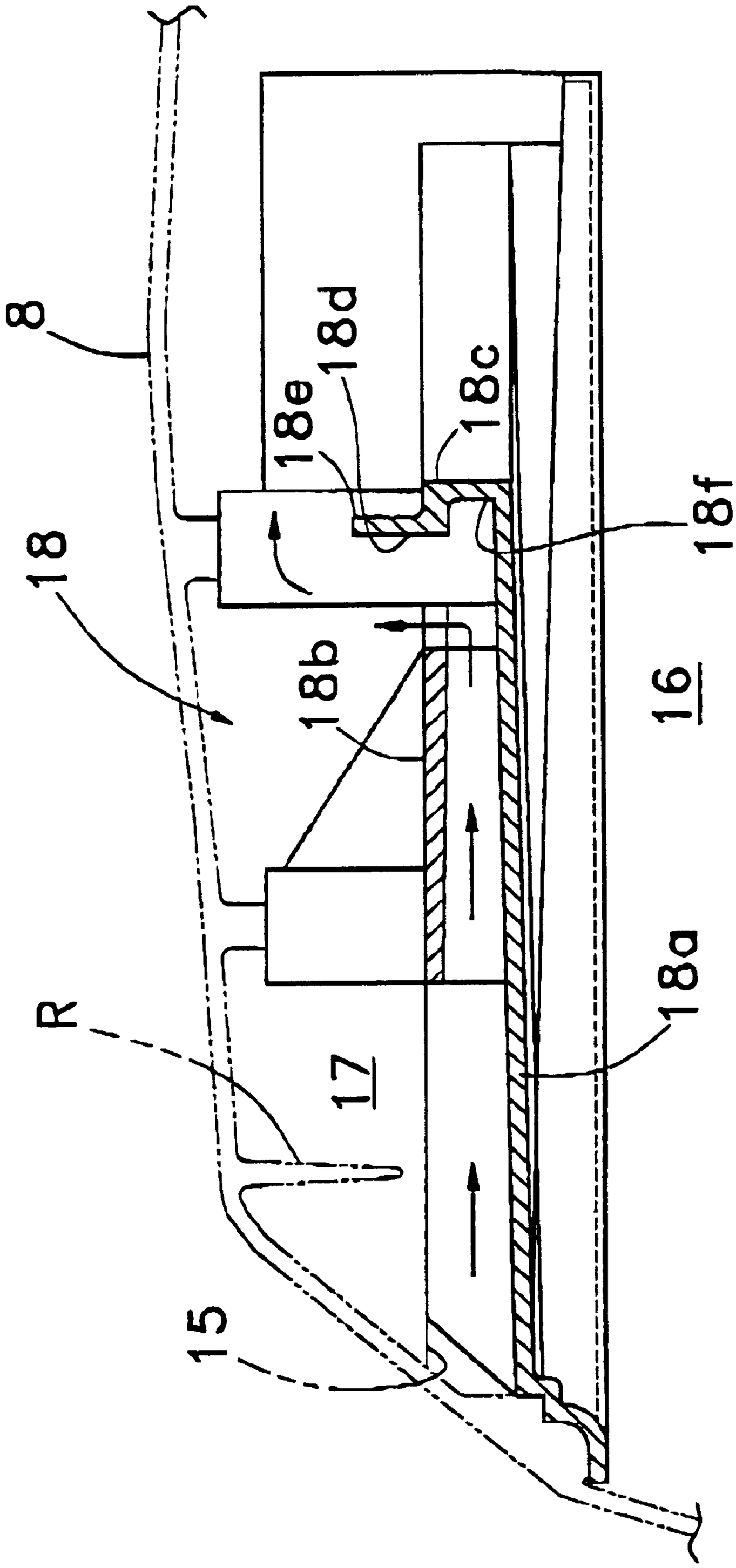


Fig. 3

AIR INTAKE ARRANGEMENT FOR OUTBOARD MARINE ENGINES

TECHNICAL FIELD

The present invention relates to an air intake arrangement for outboard marine engines, and in particular to such an air intake arrangement which can effectively remove water droplets and other foreign matters from the intake air of the engine.

BACKGROUND OF THE INVENTION

An outboard marine engine is typically covered by an engine cover so that splashes and water drops that may be included in the intake air may be effectively removed before they reach the engine. To achieve such a goal, it has been proposed, for instance in Japanese utility model publication (kokai) No. 3-51700, to provide a highly tortuous air intake passage. It has also been proposed to provide an upwardly extending cylindrical duct in the manner of a smoke stack.

However, provision of such a vertically projecting duct unacceptably increases the vertical dimension of the engine assembly. Providing such a duct inside the engine cover inevitably leads to an interference with the engine main body, and even more undesirable problems will be created. For one thing, the internal structure of the engine cover becomes unacceptably complex, not to mention the overall increase in the size of the outer profile. When the intake passage is made tortuous so that water droplets may be separated from the intake air as it passes through the intake passage, it become extremely difficult to change the design of the engine cover afterwards. It is often necessary to make small modifications to the engine cover after it is initially designed. For instance, when the passage diameter is required to be changed, when the performance of the water droplet separation has to be improved, or when the noise of the intake air flow is required to be controlled, the design of the entire engine cover having a relatively large size is required to be changed, and such a need resulted in a substantial increase in the manufacturing cost.

BRIEF SUMMARY OF THE INVENTION

In view of such problems of the prior art, a primary object of the present invention is to provide an air intake arrangement for outboard marine engines which allows a compact design of the outboard marine engine while effectively separating water droplets from the intake air.

A second object of the present invention is to provide an air intake arrangement for outboard marine engines which offers a freedom of design change.

According to the present invention, these and other objects can be accomplished by providing an air intake arrangement for an outboard marine engine assembly which is adapted to be tilted up and laterally swiveled, the engine assembly including a propulsion unit, and an engine mounted to an upper end of the propulsion unit, comprising: an engine cover covering the engine, and including a horizontally elongated slot defined in a rear part of the engine cover; and a partition wall extending substantially horizontally inside the engine cover so as to define an air introduction chamber above an engine room accommodating an engine; the partition wall including a lower plate extending horizontally along a lower edge of the slot, an upper plate extending horizontally along an upper edge of the slot, a first vertical baffle wall extending between front edges of the upper and lower plates, an opening formed in a part of the upper plate adjacent to the first vertical baffle wall, and a second vertical baffle wall extending vertically along a front edge of the opening.

Thus, the intake air is initially guided along a horizontal path between the upper and lower plates, and is forced upward through the opening by the first vertical baffle plate before it goes over the second vertical baffle plate and finally enters the engine room. Therefore, any heavier contents such as water droplets are effectively removed from the intake air by the actions of inertia and the gravitational force. When the lower plate is given with a slight incline which falls toward the slot, the water which may deposit on the lower plate is forced out of the slot by the gravitational force.

Because the intake air passage is mostly defined by the partition wall, any design change in the air intake arrangement can be readily and economically accommodated by changing the partition wall.

According to a preferred embodiment of the present invention, the front edge of the opening extend somewhat short of the first vertical baffle wall. Additionally, front edges of the lower and upper plates as well as the first vertical baffle plate **18**c define an arcuate shape as seen from above. Thereby, the water residue which may be present in the air introduction chamber is allowed to be stored in a recess defined in the innermost part of the passage between the upper and lower plates when the engine assembly is tilted upward around the tilt shaft to lift the engine assembly out of the water, and the water is allowed to flow along the first vertical baffle plate and eventually flow out of the slot as the engine assembly is turned in a side down orientation around the swivel shaft. Therefore, the water is prevented from going over the second vertical baffle plate and entering the engine room. Also when the engine is tilted up and restored to the operational position without turning it around the swivel shaft, the water that may be present on the lower plate is again allowed to safely flow out of the slot.

Optionally, the partition wall may be provided with an additional opening for communicating a ventilation hole of a belt cover of the engine with an outer opening formed in the engine cover.

BRIEF DESCRIPTION OF THE DRAWINGS

Now the present invention is described in the following with reference to the appended drawings, in which:

FIG. **1** is a see-through side view of an outboard marine engine assembly embodying the present invention;

FIG. **2** is a perspective view of the partition wall member; and

FIG. **3** is a sectional view taken along line III—III of FIG. **2**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. **1** generally illustrates an outboard marine engine assembly **1** embodying the present invention. This outboard marine engine assembly **1** is attached to a stern board of a boat (not shown in the drawing) via a stern bracket **2** equipped with clamping means. To the stern bracket **2** is connected a swivel case **4** so as to be tiltable via a tilt shaft **3** extending laterally and horizontally with respect to the boat. The swivel case **4** is provided with a vertical swivel shaft (not shown in the drawing) to allow the engine main body to be swung laterally for steering the boat. Upper and lower mount arms **5** and **6** extend rearwardly from swivel case **4**, and an extension case **7** accommodating a propeller

shaft (not shown in the drawing) is supported by free ends of these mount arm **5** and **6**.

A steering arm **4***a* integrally formed with the swivel shaft extends in the forward direction so that the steering of the boat can be accomplished by moving the steering arm **4***a* in either lateral direction via the lateral swinging motion of the engine main body.

An engine **9** is placed above the extension case **7**, and is generally covered by an engine cover **8**. A gear case **10** supporting a screw propeller **11** is attached to a lower end of the extension case **7**.

The engine **9** consists of a vertical crankshaft engine having a crankshaft which is oriented vertically in use, and, in this particular embodiment, consists of a water-cooled four-cylinder, four-stroke engine. A throttle body **12** is placed on the front end of the assembly. A manifold assembly **13** extends from a starboard side of the cylinder head in a rear end portion of the assembly **1** to the throttle body **12**, in the shape of letter L as seen from above. The manifold assembly **13** comprises four intake, tubes extending from the cylinder head and a surge tank which joins the four intake tubes and is connected to the throttle body **12**. The inlet end of the throttle body **12** is connected to a suction chamber which has an air inlet opening **13***a* directed downward.

Referring to FIGS. **2** and **3**, horizontally elongated slots **15** are formed in an upper part of the engine cover **8** along a common horizontal plane for introducing fresh air. A horizontally extending partition wall **18** extends immediately below the slots **15** so as to separate the interior of the engine cover **8** into an air introduction chamber **17** directly communicating with the slots **15** and an engine room **16** defined under the partition wall **18** and accommodating the engine **9** therein. The partition wall **18** may be made of synthetic resin or other corrosion resistant material. The partition wall **18** defines an intake air passage which directs the intake air upward immediately after it is introduced into the air introduction chamber **17**, and then directs it downward into the engine room **16** as indicated by arrows in FIG. **2**. As the intake air is thus guided, water droplets which may be contained in the intake air is separated by the actions of an inertia effect and the gravitational force.

More specifically, the partition wall **18** comprises a lower plate **18***a* which extends horizontally along the lower edges of the slots **15** and defines the upper end of the engine room **16**, an upper plate **18***b* which extends horizontally along the upper edges of the slots **15**, a first vertical baffle plate **18***c* extending vertically between the front edges of the lower and upper plates **18***a* and **18***b* so as to enclose the front end of an air passage defined between the lower and upper plates **18***a* and **18***b*, an opening **18***d* formed in a part of the upper plate **18***a* near the first vertical baffle plate **18***c*, and a second vertical baffle plate **18***e* extending vertical V from the upper surface of the upper plate **18***b* along the front edge of the opening **18***d*. As illustrated in FIG. **2**, the second vertical baffle plate **18***e* extends laterally beyond the side edges of the opening **18***d*. The front edge of the lower and upper plates **18***a* and **18***b* as well as the first vertical baffle plate **18***c* define an arcuate shape as seen from above.

The fresh air introduced from the slots **15** passes into a space defined between the lower and upper plates **18***a* and **18***b*, and travels a certain distance horizontally. The air is then obstructed by the first vertical baffle plate **18***c* and is guided upward through the opening **18***d* by the second vertical baffle plate **18***e*. Thereafter, the air flow goes over the second vertical baffle plate **18***e*, and flows downward into the engine room **16**. There is a slight incline in the lower plate **18***a* so that water which may deposit thereon is allowed to flow out of the slots **15** under the action of the gravitational force. The front edge of the opening **18***d* is located slightly short of the first vertical baffle plate **18***c* so that a recess **18***f* is defined in the innermost part of the space defined between the lower and upper plates **18***a* and **18***b*.

When stowing away the engine assembly, the engine assembly **1** as tilted upward around the tilt shaft **3** to lift the engine assembly out of the water, for instance by more than 70 degrees, and is then steered around the swivel shaft so as to face a side of the engine assembly down. Under such a condition, the water residue which may be present in the air introduction chamber **17** is allowed to be stored in the recess **18***f* when the engine assembly is tilted up, and the water is allowed to flow along the first vertical baffle plate **18***c* and eventually flow out of the slots **15** as the engine assembly **1** is turned in a side down orientation around the swivel shaft. Therefore, the water is prevented from going over the second vertical baffle plate **18***e* and entering the engine room **16**. Also when the engine is tilted up and restored to the operational position without turning it around the swivel shaft, the water that may be present on the lower plate **18***a* is again allowed to flow out of the slots **15**.

Another opening **19** is formed in the partition wall **18** on one side of the first vertical baffle plate **18***c* to supply ventilation and cooling air for the timing belt or the like in the engine room **16**, and this opening **19** communicates with an outer opening **20** formed in the engine cover **8** next to one of the slots **15** as illustrated in FIG. **1**. The vertical wall surrounding the opening **19** defines a substantially enclosed duct leading to the outer opening **20** in cooperation with the inner surface of the engine cover **8**. The opening **19** also aligns with an opening (not shown in the drawing) provided in a belt cover **21** of the engine.

In FIG. **3**, letter R denotes a rib which reinforces the part of the engine cover **8** surrounding the slots **15**, and additionally extends downwards to a level adjacent to that of the upper plate **18***b*, and along the outer periphery of the upper plate **18***b* so that water droplets which may be included in the fresh air may be forced under the upper plate **18***b* by the rib R. If desired, the rib R may reach a level substantially below the level of the upper plate **18***b* to enhance the effect of a baffle plate.

Thus, the partition wall **18** defines an intake air passage and baffle plates which are designed to effectively remove water droplets from the intake air in cooperation with the engine cover **18** itself. Furthermore, the air intake arrangement can be readily modified by changing the partition wall, and it can be relatively economically and easily accomplished as compared to the conventional arrangement which required the entire engine cover to be changed even for a slight design modification.

Although the present invention has been described in terms of a preferred embodiment thereof, it is obvious to a person skilled in the art that various alterations and modifications are possible without departing from the scope of the present invention which is set forth in the appended claims. For instance, the opening for introducing fresh air consisted of laterally elongated slots **15** in the above described embodiments, but they may be replaced with openings of other sorts, such as a large number of small holes, and a single slot extending over a relatively large distance, without departing from the broad concept of the present invention believed to be covered by the appended claims.

What we claim is:

1. An air intake arrangement for an outboard marine engine assembly which is adapted to be tilted up and laterally swiveled, said engine assembly including a propulsion unit, and an engine mounted to an upper end of said propulsion unit, comprising:

an engine cover covering said engine, and including a horizontally elongated slot defined in a rear part of said engine cover; and

a partition wall extending substantially horizontally inside said engine cover so as to define an air introduction chamber above an engine room accommodating an engine;

said partition wall including a lower plate extending horizontally along a lower edge of said slot, an upper plate extending horizontally along an upper edge of said slot, a first vertical baffle wall extending between front edges of said upper and lower plates, an opening formed in a part of said upper plate adjacent to said first vertical baffle wall, and a second vertical baffle wall extending vertically along a front edge of said opening.

2. An air intake arrangement according to claim **1**, wherein said front edge of said opening extends somewhat short of said first vertical baffle wall.

3. An air intake arrangement according to claim **2**, wherein front edges of said lower and upper plates as well as said first vertical baffle plate define an arcuate shape as seen from above.

4. An air intake arrangement according to claim **1**, wherein said lower plate is given with a slight incline which falls toward said slot.

5. An air intake arrangement according to claim **1**, wherein said partition wall is provided with an additional opening for communicating a ventilation hole of a belt cover of said engine with an outer opening formed in said engine cover.

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